FINAL YEAR PROJECT REPORT

ADVANCED DIPLOMA IN CIVIL ENGINEERING
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PIPELINE NETWORK ANALYSIS USING LINEAR THEORY METHOD

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Abstract

The objective of the project is to analyse the pipe network using linear theory method. The analysis is obtained when the flows satisfy both the continuity equation at each junction and conservation of energy equation in each pipe. Unlike the Hardy Cross method and the Newton-Raphson method, Linear theory method is not suitable for hand calculation because it used a high order matrix to solve the problem. Therefore, it is recommended to use computer and consequently the main objective of the project is to develope a software to analyse the pipe network using linear theory method.

CHAPTER 1

1.0 Introduction

Urban water networks tend to have a large number of branches of pipes and design for network means design for water to flow in all pipes and avoid water becoming stagnant in any one pipe. It also must be possible for the water to reach any distribution point by more than one part, so that distribution is not interrupted in event of repairs or failure in any pipe.

Design criteria are that specified minimum flow rates and pressure heads must be attained at outflow points of the network. Pipe network analysis involves the determination of the pipe flow rates and pressure heads which satisfy the flow continuity at each junction [i.e., flow in = flow out + discharge (or storage)] and the conservation of energy around each closed loop.

These may be stated:

a) Continuity - The algebraic sum of flow rates in the pipes meeting at a junction, together with any external flows, is zero.

$$\sum_{I=1}^{I=NP(J)} Q_{IJ} - F_J = 0, J=1, NJ........(1.0)$$

where:

Q_{IJ} = Flow rate in pipe IJ, at junction I

NP(J) = Number of pipes meeting at junction J

F_J = external flow rate (outflow) at J

NJ = total number of junctions in the network.

b) Energy conservation - The algebraic sum of the head losses in the pipes, together with any heads generated by in-line booster pumps, around any closed loop formed by pipes is zero

$$\sum_{J=1}^{J=NP(I)} h_{L,I,J} - Hm,_{IJ} = 0, I=1, NL...........(1.1)$$

where:

$h_{L,I,J}$ = head loss in pipe J of loop I

$Hm,_{IJ}$ = manometric head generated by a pump in line I,J